

Unit 11 – Digestion and Nutrition

Pleasant Valley High School
Anatomy and Physiology

15.1 Introduction

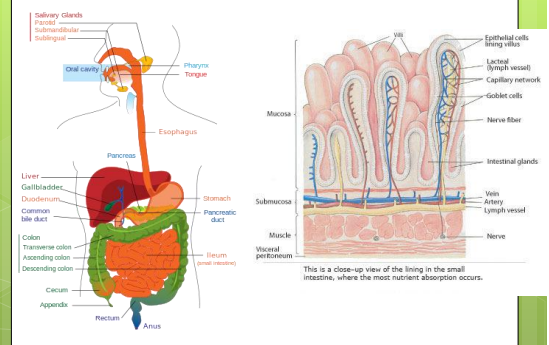
- Digestion is the mechanical and chemical breakdown of food and the absorption of the resulting nutrients
- Made up of the alimentary canal (9 meters in length) from the mouth to the anus, several accessory organs
 - Alimentary canal – mouth, pharynx, esophagus, stomach, small intestine, large intestine, anal canal
 - Accessory organs – salivary glands, liver, gall bladder, pancreas

- 3 kinds of processing
 - Digestion
 - Absorption
 - Metabolism

15.2 General Characteristics of the Alimentary Canal

Structure of the Wall

- 4 Layers
 - Mucosa
 - Innermost layer, coats the inner lining of the canal
 - Submucosa
 - CT, contains blood vessels and nerves
 - Muscularis
 - Muscle tissue move food through peristalsis
 - Serosa
 - Outermost layer



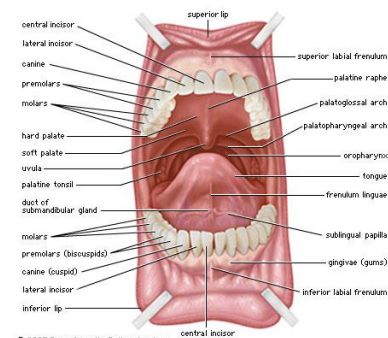
15.3 The Mouth

Mouth

- Hollow chamber with a roof, floor, and walls
- Where digestion begins
- Roof is made of a hard (bone) and soft (muscle) palate
- Uvula – hangs from the palate, prevents food/liquid from entering the nasal cavities

Mouth Cont'd

- Floor of the mouth is the tongue and its muscles
- Tongue is anchored to bone and attached to the floor by the frenulum
- The taste buds are located on the papillae – small elevations on the surface of the tongue

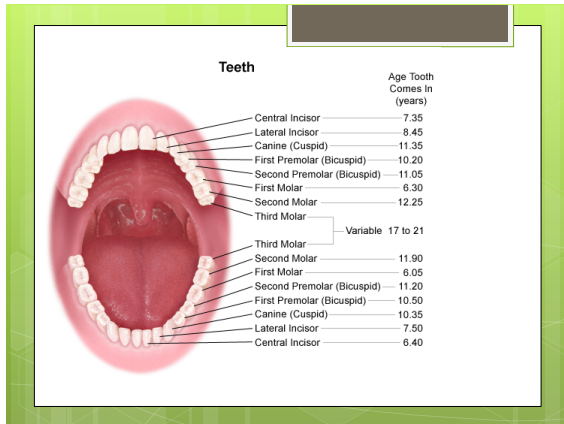


Teeth

- 4 types of teeth
 - Incisors – sharp cutting edges
 - Canines/cuspids – tear food
 - Premolars/bicuspid – help break down food
 - Molars/tricuspid – help break down food
- Bolus – mass of food that has been chewed and is ready to be swallowed
- Adults have 32 teeth
- Primary teeth – develop between ages of 6 mos. to 2 years, *deciduous teeth*
 - 20 *deciduous teeth*

Teeth Cont'd

- Divided into 3 main parts
 - Crown
 - Exposed portion, covered by enamel, the hardest tissue in the body
 - Neck
 - Narrow, joins the crown to the root
 - Root
 - Fits into the jaw

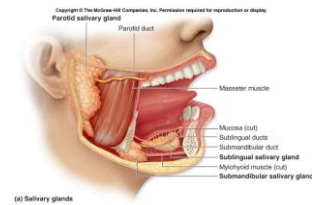


15.4 Salivary Glands

Salivary Glands

- 3 pairs secrete almost all saliva (1 liter) per day
 - Parotid – largest, below the ears
 - Submandibular – open into the mouth next to the lingual frenulum
 - Sublingual – open into the floor of the mouth
- Saliva contains mucous (moisten food) and salivary amylase (digestion of carbs)

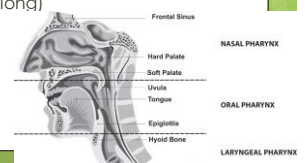
The Salivary Glands



15.5 Pharynx and Esophagus

Pharynx and Esophagus

- Pharynx – located behind nasal cavities and mouth
- Esophagus
 - Connects the pharynx to the stomach (approx. 10 inches long)



Pharynx

- Split into three parts – nasopharynx, oropharynx, laryngopharynx

Swallowing Mechanism

- 6 Step Process
 - Soft palate raises preventing food from entering nasal cavity
 - Hyoid and larynx are elevated, epiglottis raises to prevent food from entering trachea
 - Tongue pressed against soft palate
 - Pharyngeal muscles contract pulling the pharynx upwards
 - Muscles in lower section of pharynx relax, opening the esophagus
 - Peristaltic wave begins in the pharynx and forces food into the esophagus

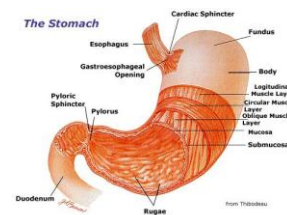
15.6 The Stomach

Stomach

- J shaped, pouch like organ that hangs inferior to the esophagus
- Food passes through the cardiac sphincter at the end of the esophagus and enters the stomach
- Digestion continues when food is mixed with gastric juices and breaks into a semisolid mixture, chyme
 - Gastric juices contain HCl and enzymes

Stomach cont'd

- 3 sections
 - Fundus – enlarged portion to the left of the esophagus
 - Body – central portion
 - Pylorus – lower narrow section, connects to the small intestine



Gastric Secretions

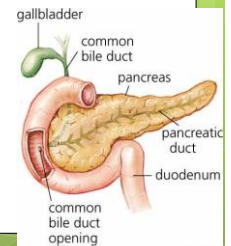
- Mucous membrane is thick with many openings called *gastric pits*
- These are at the ends of **gastric glands**
- The products of *chief cells*, and *parietal cells* is gastric juice
- *Pepsin* – the most important digestive enzyme, chief cells secrete it as pepsinogen, but in touch with HCl it quickly becomes pepsin
- Mucous cells- secrete mucous that lines the inner wall preventing stomach from digesting itself
- *Intrinsic Factor* – secreted by parietal cells, helps small intestine absorb vitamin B12

Regulation of Gastric Secretions

- *Gastrin* – hormone released by certain stomach cells in order to increase secretory activity of gastric glands
- *Cholecystokinin* – peptide hormone that promotes the motility of the small intestine

15.7 Pancreas

- Behind the stomach, secretes pancreatic juice into the duodenum



Pancreatic Juice

- Contains enzymes that digest carbs, fats, nucleic acids, and proteins
- Protein splitters are *trypsin*, *chymotrypsin*, and *carboxypeptidase*
- *Pancreatic Amylase* – “the carb buster”
 - *Pancreatic Lipase* – breaks down the simple sugars created by amylase into fatty acids and glycerol
 - *Nucleases* – break apart nucleic acids into nucleotides

Regulating the Pancreas

- *Secretin* – released into the duodenum as chyme enters, this hormone has bicarbonates that neutralize the acidic chyme
- *Cholecystokinin*- stimulated release when the duodenum detects proteins and fats

15.8 The Liver and Gallbladder

- Liver
 - Secretes bile into the duodenum through the hepatic duct (breaks up fats and eliminates cholesterol through feces)
 - Divided into a large right lobe and small left lobe
 - Each lobe divided into many tiny *hepatic lobules*, the functional units of the liver
 - Vascular channels called *hepatic sinusoids* channel from a central vein
 - *Hepatic ducts* – carry bile

Bile

- Yellowish – green liquid that hepatic cells continuously secrete
- Made of bile salts, bile pigments, cholesterol, and electrolytes
 - Only bile salts play a role in digestion

Gallbladder

- Pear shaped sac located in the depression on the liver's inferior surface
- Connects to the cystic duct which connects to the common hepatic duct
 - When they merge it forms the common bile duct
 - The hepatopancreatic sphincter prevents the flow of bile (located in the duodenum)

15.9 Small Intestine

Small Intestine

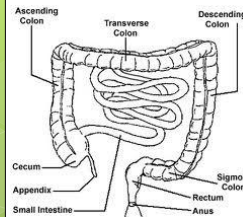
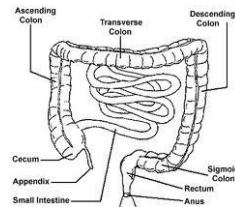
- About 20 feet long, but very small diameter
- Divides into three sections: duodenum, jejunum, ileum
- Mucous lining contains glands that secrete intestinal digestive juices
- Intestinal lining is arranged into folds called *plicae* covered in villi
 - Villi absorb the products of digestion of carbs and proteins (sugars and aminos)
 - Lacteals in the villi absorb fat materials from chyme

- Mesentery – a double walled peritoneal membrane that suspends the small intestine in the visceral cavity
- Know the secretions of the Small Intestines and the Absorption process of the small intestines

15.10 The Large Intestine

Parts of the Large Intestine

- Large intestine is named due its large diameter
- Cecum – pouch-like structure at the opening of the ileum
- Appendix – absolutely no function...but contains lymphatic tissue
- Colon – four parts
 - Ascending, transverse, descending, and sigmoid



- Rectum – follows the curvature of the sacrum, extends 5cm below the coccyx
- Anus – the final depository of the digestive system, guarded by two sphincter muscles (internal and external anal sphincters)

- Know the structure, functions, and movements of the large intestine
- Feces – material that was not digested, mucous, shed intestinal cells, bacteria...a fun mix of anal expulsion
 - The odor is from bacterial products (namely methane)

15.11 Nutrition and Nutrients

Carbohydrates

- Organic compounds used for energy supply
- Starch from grains, glycogen from meat, cane sugar, honey, fruits
- Cellulose – complex carb in food (crunch of celery), hard to digest, provides a surface for the intestines to push on
- 125-175 grams is needed for daily intake
- Should supply around 60% of a person's diet

Lipids

- Organic compounds that include fats, oils, and fat like substances
- Triglycerides are found in plant and animal based foods
- Saturated fats are found in meats, dairy, and eggs
- Unsaturated fats are found in seeds, nuts, and plant oils
- Cholesterol is found in liver and egg yolks, typically not found in plant material
- Should be no more than 30% of daily diet

Proteins

- Polymers of amino acids
- Proteins go through *deamination*, breaking apart in the liver, taking the nitrogen and making urea
- Found in meats, fish, cheese, nuts, milk, grains, legumes
- Should be around 10% of daily diet
- Should take in about 0.8 grams per kilogram of a person's weight

Vitamins

- Organic compounds needed in small amounts for normal metabolism
- Classified as either Fat soluble or water soluble
 - Fat Soluble – A, D, E, K
 - Water Soluble – B, C
- Know the specific function of Vitamins B and C

Minerals

- Dietary elements other than carbon
- Responsible for about 4% of a person's body weight
 - Major Minerals (75%) – calcium and phosphorus
 - Other major minerals (0.05% each) – potassium, sulfur, sodium, chlorine, magnesium
 - Trace Minerals – each make up less than 0.005% of body weight
 - Iron, manganese, copper, iodine, cobalt, zinc, fluorine, selenium, chromium

Adequate Diet

